

On the *Rhyopsocus* Hagen, 1876 (Insecta: Psocoptera) of East Africa with a description of two new species

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Abstract: Finds of four *Rhyopsocus* species in East Africa were reported, two of which from Uganda were described as new to science. Other two were *R. afer* from Tanzania, and *R. pandanicola* from coastal Kenya. Information on the colouration, morphology and somatometrics was provided. An identification key for all known African species was proposed.

Keywords: Africa, biodiversity, invertebrates, tropical

Introduction

The genus *Rhyopsocus* Hagen, 1876 consists of 24 known species spread in the warm parts of Africa, North and South America, and some oceanic islands (Lienhard 2016). Some of the species occupy typical psocid microhabitats like living or dry plants and leaf litter, and some are possibly more specialised tending to inhabit nests of birds or rodents (Badonnel, 1948; Baz, 1990; Mockford, 2016). These insects are easily spread by humans and often found in stored fruit products (Pearman, 1931; New, 1974). However, very little is known on the ecology of the *Rhyopsocus* and the species diversity of the genus is far from well known (Mockford, 2016). In this paper I report in detail all of mine *Rhyopsocus* finds in Africa till now, two of which represent new species to science.

Material and methods

Psocoptera were collected by the author from East Africa – Kenya, Tanzania (Zanzibar) and Uganda by beating the vegetation. The specimens were stored in 96% ethanol. The photos (specimens in glycerin) were taken by a camera Canon PowerShot SX500IS through the eyepiece of a light microscope Optika and Carl

Zeiss-Jena. Type material was deposited at the National Museum of Natural History, Sofia, Bulgaria (NMNH), Natural History Museum of Geneva, Switzerland (NHMG) and the particular collection of the author. The species discussed in the paper were identified according to original descriptions, redescriptions, and published identification keys. Measurements followed Lienhard (1998). Species diversity and distributions is according Lienhard (2016).

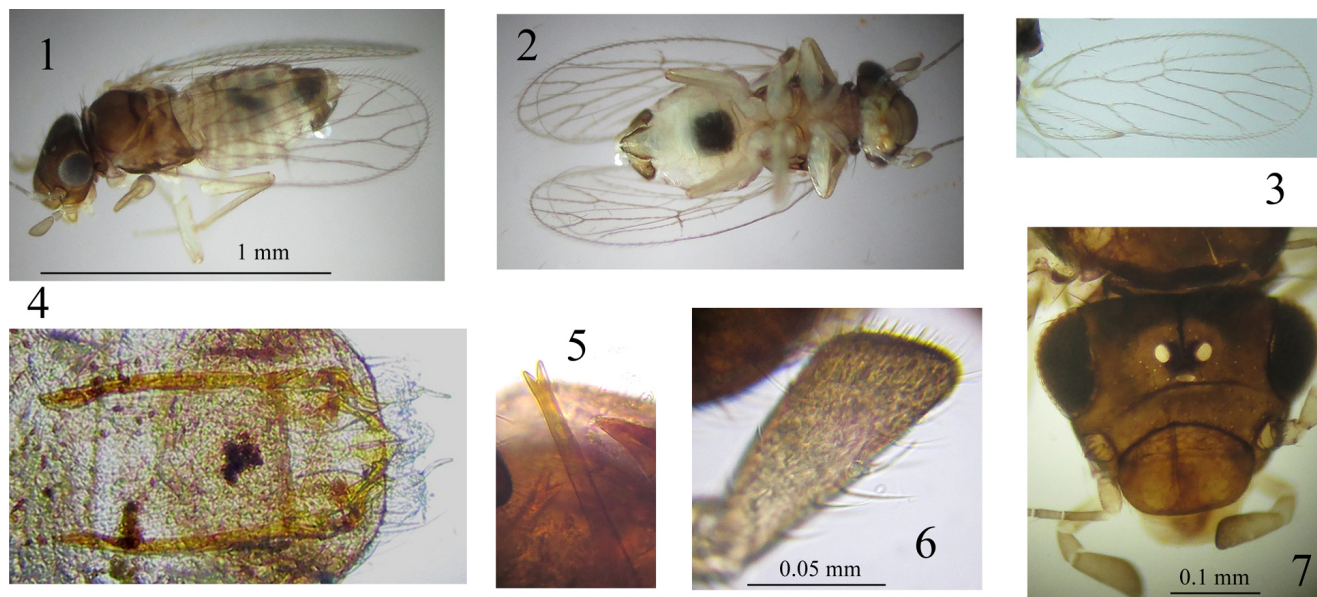
Measurements abbreviations (all in mm in the text): LC = body length; A = antenna length, P4: fourth segment of maxillary palp, F+tr = hind femur and trochanter length; T = hind tibia length; t1, t2, t3 = tarsomeres of hindtarsus (lengths measured from condyle to condyle), FW = forewing, HW = hindwing, D = anteroposterior diameter of the compound eye, IO = shortest distance between compound eyes.

Results and discussion

Family Psoquillidae Lienhard & Smithers, 2002

Rhyopsocus ugandanus n. sp.

Holotype ♀ (in 96% ethanol), Uganda, Buvi Village area, a small peninsula at Lake Viktoria NW of



Figs 1–7. *Rhyopsocus ugandanus* n. sp., (1) lateral view, paratype ♀, (2) ventral view of same specimen, (3) forewing, holotype ♀, (4) phallosome, hypandrium, epiproct and paraprocts, paratype ♂, (5) lacinia of same specimen, (6) P4, paratype ♀, (7) head, paratype ♀ (scale of Fig. 1 valid for 2 and 3; Figs 4–5 not to scale).

Entebbe Town, N0.12306° E32.45378°, 1133 m a.s.l., 25.07.2022; NMNH; paratypes: 1 ♂ (in 96% ethanol), same locality and date; NMNH; 1 ♂, 1 ♀ (in 96% ethanol), same locality and date; NHMG. Additional material: 1 ♂ (different body parts on microscope slides, in glycerin), same locality and date; D. Georgiev coll.

Diagnosis: The phallosome and P4 (4th segment of the palpus) morphology of the new species is similar with these ones of *R. ocotensis*. But together with its body colouration, *R. ugandanus* n. sp. differs and by its reduced and flat middle ocellus, paraprocts and hypandrium morphology. By its forewing venation and brown head and thorax *R. ugandanus* n. sp. is similar and to *R. peregrinus* (Pearman, 1929). This species was shortly described by a single specimen in stored bananas in Great Britain with unknown origin by a single specimen with unknown sex. However, in *R. peregrinus* the hind wings are considerably smaller than the forewings (New, 1974), while in *R. ugandanus* n. sp. they are just a little bit shorter, prolonging to about 90% of the forewing length even in the brachypterous specimens.

There are three species of macropterous *Rhyopsocus* having banded abdomen (Banks 1930, Mockford, 2016; Thornton et al., 1972). From *R. texanus* (Banks, 1930) (known from USA and Mexico) and *R. celtis* Mockford, 2016 (USA) it differs by its

darker head and thorax, and from *R. pandanicola* Thornton, Lee & Chui, 1972 (Micronesia, Christmas Island, Tonga) by its not pigmented wings and paler abdomen.

Etymology: The species is named after Uganda – the country where it was found.

Description (after two months in 96% ethanol): **Colouration.** In both sexes identical. Head and thorax dark blackish-brown, lighter ventrally. Compound eyes black with greyish tinge. Ocelli yellowish (Fig. 7). Legs, antennae and palpi brown, lighter proximally. Abdomen white-yellowish, tergites with brown transverse stripes interrupted ventrally. Terminal sclerites dark brown. Wings hyaline (Figs 1–3).

Morphology. Female: The distance between the compound eyes is twice as their anteroposterior diameter. Lateral ocelli round, the middle ocellus elongate, flattened, and somehow reduced (Fig. 7). Flagellum of the antenna with 20 flagellomeres. P4 broad distally with long setae at its major external surface and rather short at its apical part (Fig. 6), resembling this one of *R. ocotensis* García-Aldrete, 1999 (see García-Aldrete, 1999: p. 228). Lacinia slim, with two cusps from which the lateral one is slightly longer (Fig. 5). Tibia and femur + trochanter almost equal in length. In flying forms the wing is almost as long as the body length, and wings are passing over the abdominal tip. Wing veins well defined. Forewings

with moderately short setae (Figs 1–3). Forewing venation variable even in one and a same individual mainly considering the length of cells m1 and r3, and the shape and length of the central cell. Gonapophyses elongate, with long sclerotised band at its dorsal edge, more membranous ventrally. With two very long setae apically, a few little bit shorter and many which are half their size (Fig. 23). Epiproct and paraprocts with scattered short setae, epiproct with additional row of longer setae. Paraproctal spur short and could be straight or slightly curved outwards (there is no any difference between the male and female) (Fig. 4).

Male: Smaller than the female (LC < 1.0 mm). Antennae longer compared to body length than these in female (♀ A/LC = 0.83, ♂ A/LC = 0.92). P4 narrower than this in female, more rounded and having longer setae at its apical area. In two of the males forewings longer than body length, shorter in the third (see measurements). Eyes are insignificantly larger than those in female compared to the shortest distance between them. Hypandrium simple, rounded with flattened apex, setose, having two pairs of closely situated, curved and very long setae at its lateral edge (Fig. 26). Phallosome with two slender parallel projections (anterior endophallic sclerites) and two triangular sclerites (Edeagal arch + Posterior endophallic sclerites), one at each side of longitudinal midline (Fig. 4). Epiproct and paraprocts scarcely setose with shorter setae than those in female. Other characters as in female.

Dimensions: Holotype ♀: LC = 1.04, P4 = 0.12, F+tr = 0.44, T = 0.45, t1 = 0.18, t2 = 0.04, t3 = 0.03, FW = 1.02, HW = 0.88, D = 0.15, IO = 0.30, IO/D = 2.0; paratype ♀: LC = 1.04, P4 = 0.12, A = 0.86, FW = 1.0, D = 0.10, IO = 0.22, IO/D = 2.2; paratype ♂: LC = 0.96, A = 0.88, F+tr = 0.35, T = 0.40, t1 = 0.16, t2 = 0.05, t3 = 0.05, FW = 1.0, HW = 0.88, D = 0.16, IO = 0.30, IO/D = 1.88; paratype ♂ (with not well developed wings): LC = 1.1, FW = 0.78, HW = 0.66.

Distribution: Known only from the type locality.

Type locality: Uganda, Buvi Village area, a small peninsula at Lake Viktoria NW of Entebbe Town, banana (*Musa* sp.) plantation, NE of Buvi Lodge, from fallen village weaver *Ploceus cucullatus* (Müller, 1776) nests beneath a date palm (*Phoenix* sp.), N0.12306° E32.45378°, 1133 m a.s.l.

Habitat: The species was found during the dry season at agricultural lands – banana (*Musa* sp.) plantation, from fallen village weaver *Ploceus cucullatus* (Müller, 1776) nests beneath a date palm

(*Phoenix* sp.). The fallen nests were found among tall grass vegetation, lianas and dry date palm leaves.

Rhyopsocus weingardti n. sp.

Holotype ♂ (with detached abdomen and a hind wing; in 96% ethanol), N0.12306° E32.45378°, 1133 m a.s.l., 25.07.2022; NMNH.

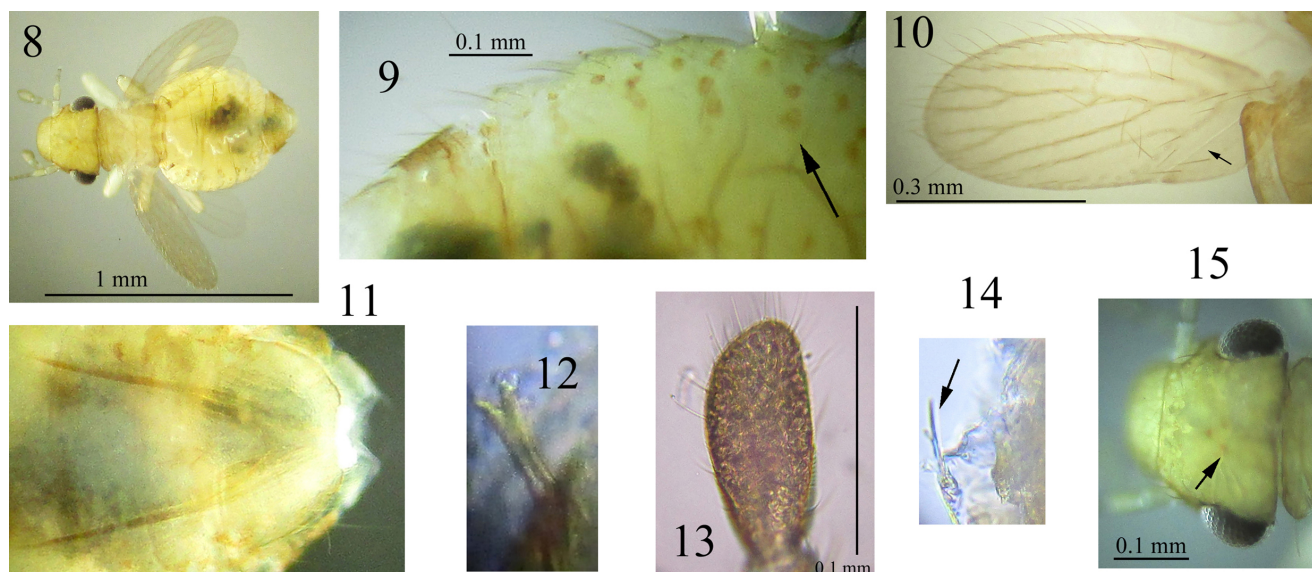
Diagnosis: The specific Y-shape pattern of spots on each dorso-lateral side of the abdominal tergites is unique for this species.

There are three yellowish-brown *Rhyopsocus* species known so far. *R. calakmulensis* García-Aldrete, 1999 (Mexico) has no ocelli (even vestigial) and wings with shorter setae and not well defined veins (García-Aldrete, 1999); *R. disparilis* (Pearman, 1931) has no ocelli (even vestigial) too, and more elongate wings with different venation (Pearman, 1931); *R. plesiafer* Turner & Cheke, 1983 (Togo) has pale terminalia and maxillary palps, not pigmented forewings, and the paraproctal spur is curved outwards (Turner & Cheke, 1983).

Etymology: Named after my colleague, the psocidologist Michael Weingardt (Friedrich Schiller University, Jena, Germany).

Description (after two months in 96% ethanol): Colouration. The whole animal is yellowish-brown (Fig. 8). The head, thorax and terminal sclerites a little bit darker, more brownish. Compound eyes black with greyish tinge. Vestigial ocelli reddish-brown (Fig. 15). Each dorsolateral side of the preclunial abdominal tergite with four brown spots forming Y-shape pattern (Fig. 9). Wings greyish-brown, transparent (Fig. 10). Forewings darker. Both forewing and hindwing with a narrow hyaline band along cu2 (Fig. 10). Veins dark, brown and well visible.

Morphology. Male: The distance between the compound eyes is twice as their anteroposterior diameter. Ocelli not well developed, only three vestigial rounded ocelli present. P4 narrow proximally, elongate-rounded distally and has both long and short setae at its apical area (Fig. 13). Lacinia bifurcated having two cusps of almost equal length (Fig. 12). The forewings are short and do not pass over the abdominal tip. Venation well defined as shown on Fig. 10. Forewing with long setae. Epiproct and paraprocts with scattered setae. Paraproctal spur distinctly curved inwards (Fig. 14). Hypandrium simple, with concave apex, setose, having two groups of four setae at its



Figs 8–15. *Rhyopsocus weingardti* n. sp. (♂ holotype), (8) dorsal view, (9) specific for this species Y-shape pattern of the dorso-lateral side of the abdominal tergites, (10) forewing, (11) phallosome, (12) lacinia, (13) P4, (14) paraproctal spur, (15) head, vestigial ocelli pointed by an arrow (Figs 11, 12, 14 not to scale).

lateral edges arranged in rows (Fig. 27). Phallosome with thin arms arranged at an acute angle (Fig. 11).

Female: Unknown.

Dimensions: Holotype ♂: LC = 1.0, P4 = 0.09, F+tr = 0.30, T = 0.35, t1 = 0.10, t2 = 0.05, t3 = 0.04, FW = 0.59, HW = 0.47, D = 0.12, IO = 0.25, IO/D = 2.08.

Distribution: Known only from the type locality.

Type locality: Uganda, Buvi Village area, a small peninsula at Lake Viktoria NW of Entebbe Town, banana (*Musa* sp.) plantation, NE of Buvi Lodge, from fallen village weaver *Ploceus cucullatus* (Müller, 1776) nests beneath a date palm (*Phoenix* sp.), N0.12306° E32.45378°, 1133 m a.s.l.

Habitat: Same as in *R. ugandanus* n. sp.

Rhyopsocus afer (Badonnel, 1948)

Material examined: The specimen reported by Georgiev (2021) was reexamined, photographed and measured: 1 ♀, 28.02.2021, Tanzania, Zanzibar, Unguja Island, Michamwi Peninsula, yard of a hotel, among *Cocos nucifera* and *Pandanus* sp., from fallen nest of golden weaver, *Ploceus subaureus* (Smith, 1839), S6.14181° E39.48986°, 5 m a.s.l.; NMNH.

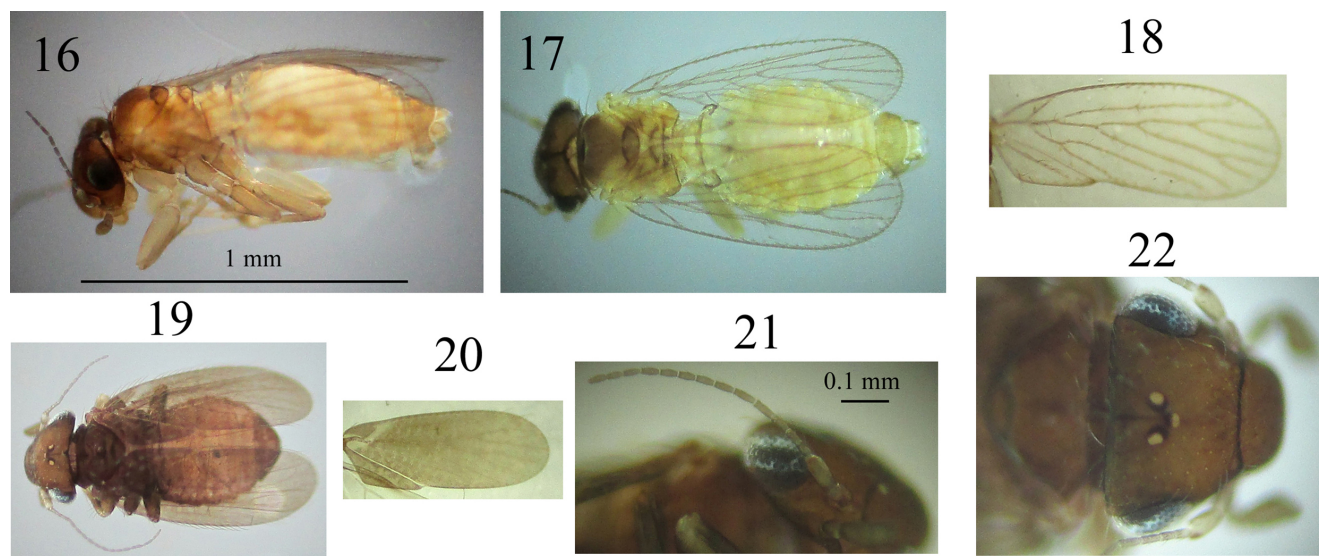
Description of the specimen: Colouration (after 19 months in 96% ethanol). Head, thorax, antennae and

palpi dark brown (Fig. 16). Compound eyes black. Ocelli pale. Abdomen and legs yellowish-white. Terminal sclerites a little bit darker (Fig. 17). Wings hyaline, veins brownish (Fig. 18).

Morphology. Compound eyes relatively big (IO/D < 2). Flagellum of the antenna with 21 flagellomeres. P4 moderately broad and rounded distally, with relatively short setae at its apical part. Lacinia bifurcated having slightly longer lateral cusp and thickened stem. Forewings slightly bent above the abdomen, with variable venation (Fig. 18). Most noticeable is that in left wing cell m1 is much shorter than r3, and in the right they are almost equal in length. Gonapophyses elongate, with long sclerotised band at its dorsal edge, more membranous ventrally. With one very long seta apically and two shorter in close proximity (Fig. 25).

Dimensions: LC = 1.2, P4 = 0.10, F+tr = 0.33, T = 0.39, t1 = 0.17, t2 = 0.04, t3 = 0.05, FW = 0.84, HW = 0.80, D = 0.15, IO = 0.28, IO/D = 1.87.

Remark: The differences from the original description of Badonnel (1948) from Congo which was observed in the Zanzibar specimen was that the antennae were brown (versus pale), the paraproctal spur was slightly curved inwards (versus straight), and the gonapophyses had only one very long seta apically (versus two). Further studies of more samples are needed to clarify if it is an individual or local variation



Figs 16–22. *Rhyopsocus afer* ♀ from Zanzibar, (16) lateral view, (17) dorsal view, (18) forewing, *Rhyopsocus pandanicola* ♀ from Kenya, (19) dorsal view, (20) forewing, (21) head, lateral view, (22) head, dorsal view (scale of Fig. 1 valid and for 17–20, scale of Fig. 21 valid and for 22).

of *R. afer*, or the Unguja population belongs to a separate species.

Rhyopsocus pandanicola Thornton, Lee & Chui, 1972

Material examined: 1 ♀, 4.03.2022, Kenya, South of Mombasa, at the coast of the Indian Ocean, along the estuary of Congo River, mangrove scrubs, S4.25842° E39.59481°, 6 m a.s.l., from various bushes and trees, collected by beating the vegetation. Reported by Georgiev (2022) as *Rhyopsocus* sp.

Description of the specimen: Colouration (after seven months in 96% ethanol). The whole animal is dark brown (Fig. 19). Compound eyes black with two parallel longitudinal greyish-blue stripes (Fig. 21). Ocelli pale, with darker pigment at their inner sides (Fig. 22). Tibia light at its most distal part. Tarsi light. Forewings blackish-brown having a translucent-whitish band at the base and narrow hyaline band along cu2 (Fig. 20). Hindwing a little lighter, with blackish-brown hue and narrow hyaline band along cu2 too.

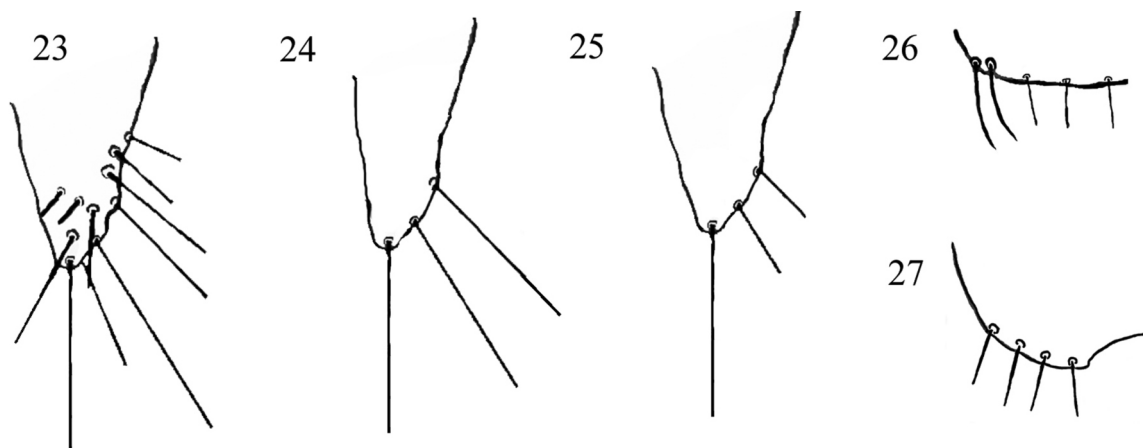
Morphology. Flagellum of the antenna with 19 flagellomeres. Ocelli rounded, middle ocellus smaller (Fig. 22). Forewings longer than body length, passing a lot over the abdominal tip, with long setae and a lot of tiny ones all over the wing surface (Fig. 19). Hindwings also long, almost as long as body length.

Gonapophyses slim, with three very long setae at the apical area (Fig. 24).

Dimensions: LC = 0.78, P4 = 0.09, F+tr = 0.24, T = 0.32, t1 = 0.10, t2 = 0.04, t3 = 0.05, FW = 0.81, HW = 0.76, D = 0.11, IO = 0.23, IO/D = 2.09.

Habitat: The species was found on mangrove bushes at a river estuary of the tidal zone of the Indian Ocean.

Remark: *R. pandanicola* was known from Micronesia, Christmas Island and Tonga (Lienhard, 2016). The find on coastal Kenya is a new record of the species for the African continent. The specimen recorded fits well with the description of Thornton et al. (1972). The slight colour differences pointed by Georgiev (2022) could be due to long time of preservation of 20 years of the specimens according to which the species was described. As an additional different character from the original description of *R. pandanicola* can be added the presence of two grey-blue stripes on the compound eye of the African specimen. Of course the possibility that they are closely related separate species cannot be excluded. However some psocid species considered to have Oriental distribution were recently found and at the shores of East Africa as *Lepidopsocus pretiosus* (Banks, 1942), *Belaphopsocus murphyi* Lienhard, 1991 and *Peritroctes cochinchensis* Menon, 1938, and a record of *R. pandanicola* is not surprising (Georgiev,



Figs 23–27. (23) *R. ugandanus* n. sp. ♀, gonapophysis; (24) *R. pandanicola* from Kenya, ♀, main setae on the apical area of gonapophysis; (25) *R. afer* from Zanzibar, ♀, main setae on the apical area of gonapophysis; (26) *R. ugandanus* n. sp. ♂, lateral area of the hypandrium; (27) *R. weingardti* n. sp., ♂, lateral area of the hypandrium.

2021, 2022). Many species are probably distributed along the Indian Ocean coast, probably due to both natural processes of passive dispersal and human introductions.

Identification key to the known African *Rhyopsocus* species

As the forewing venation tends to vary (even in a single specimen as was noticed in this study) it was not used as an important character in building of the identification key. Mostly the criteria of Mockford (2016) were applied.

- 1. Head and thorax brown, abdomen pale 2
- Body relatively unicoloured 3
- 2. Abdomen unicoloured,
yellowish-white *R. afer* (Badonnel, 1948)
(Angola, Congo, Equatorial Guinea, India, Ivory
Coast, South Africa, Tanzania, Zanzibar)
- Abdomen striped *R. ugandanus* n. sp.
- 3. Body pale 4
- Body dark brown 5
- 4. Ocelli absent *R. disparilis* (Pearman, 1931)
(Great Britain, USA, Angola, Congo, Ghana)
- Ocelli present 6
- 5. Anal margin of forewing angulated, veins well
visible *R. pandanicola* Thornton,
Lee & Chui, 1972 (Micronesia, Christmas Island,
Tonga)

- Anal margin of forewing smoothly rounded, veins
hardly visible *R. nidicola* Baz, 1990
(Equatorial Guinea)
- 6. Body yellowish-brown, dorsolateral margin
of abdominal tergites with Y-shape
pattern *R. weingardti* n. sp.
- Whole body unicoloured pale
brown *R. plesiafer* Turner & Cheke, 1983
(Togo)

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